

OPEN PROBLEMS AND FUTURE WORK

JIŘÍ VORBA
WETA DIGITAL

Alita: Battle Angel | © 2018 Twentieth Century Fox Film Corporation

IDEAL METHOD

- Path tracing
- Progressive rendering
- Fast learning (small sample counts)
- Always on
- Small to zero overhead in simple scenes

On-line Learning of Parametric Mixture Models for Light Transport Simulation

Jiří Vorba^{1*}

Ondřej Karlík^{1*}

Martin Šik^{1*}

Tobias Ritschel^{2†}

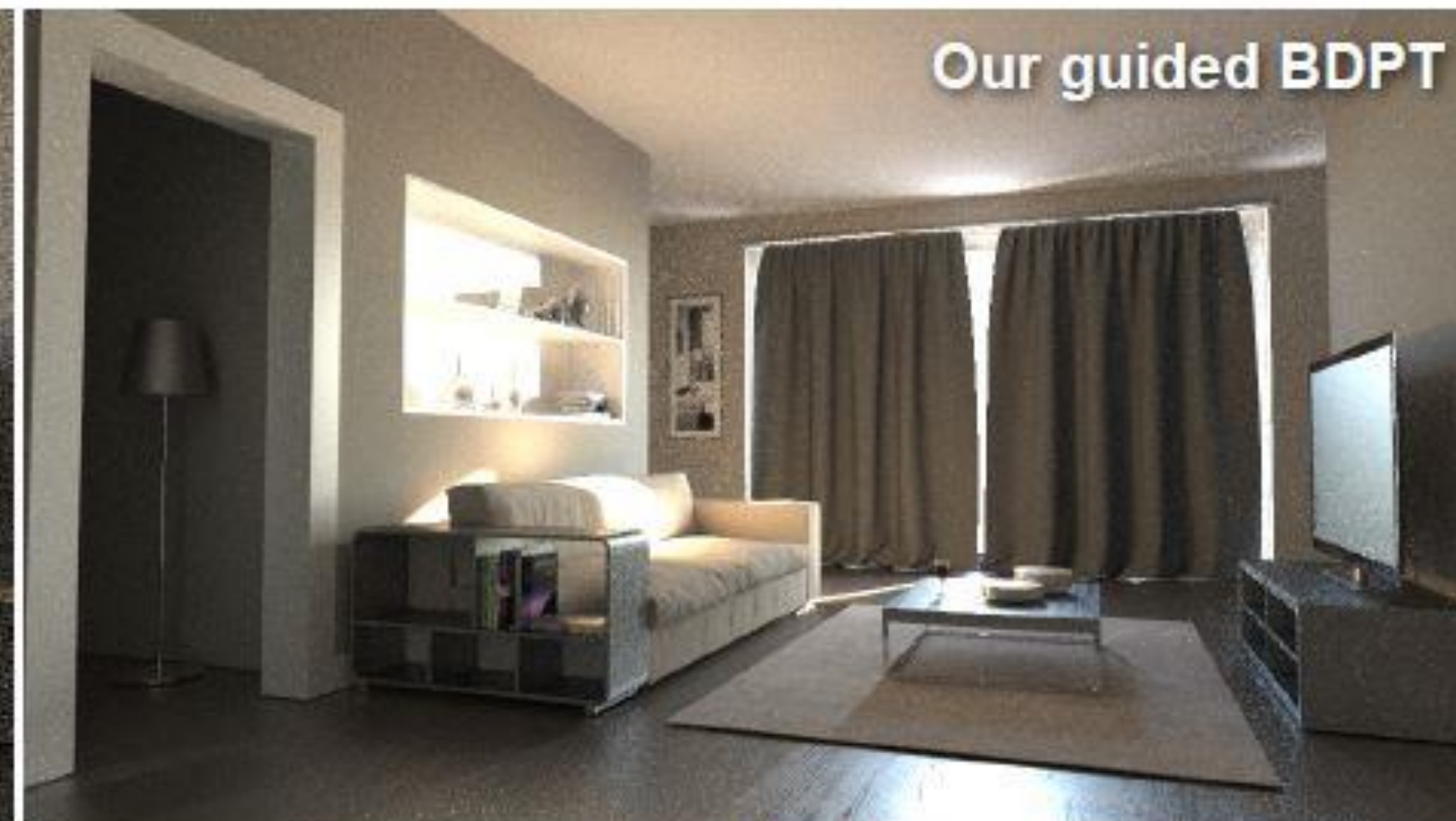
Jaroslav Krivánek^{1‡}

¹Charles University in Prague

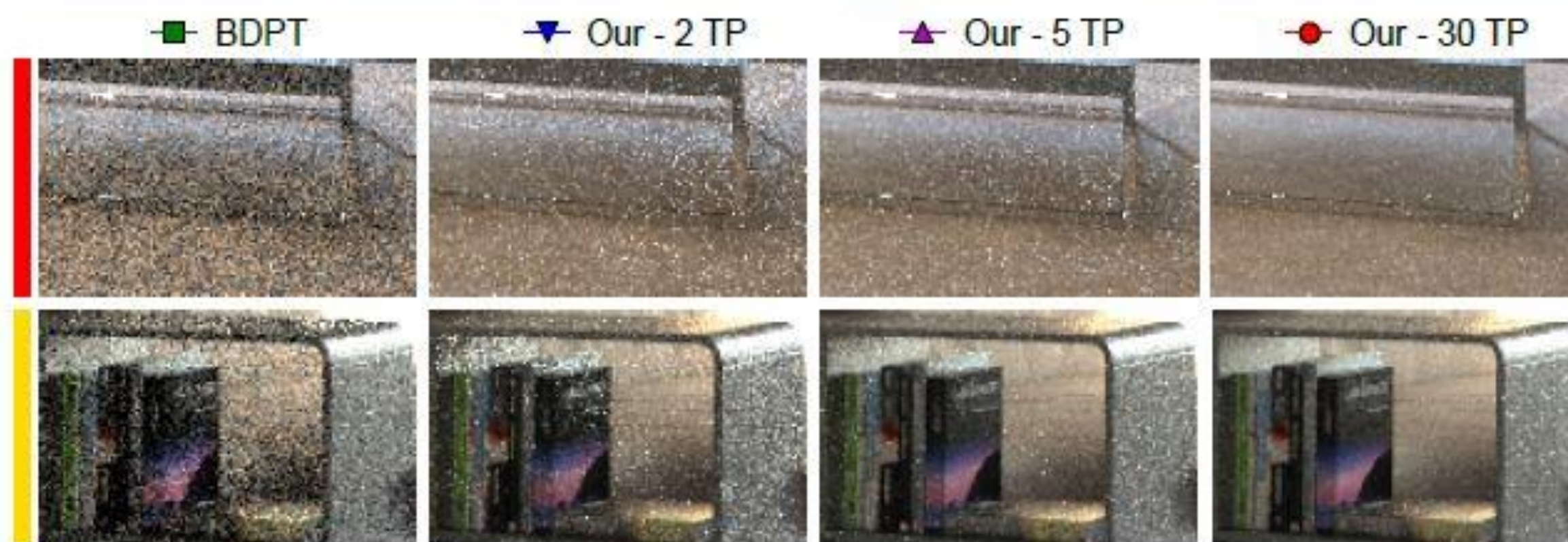
²MPI Informatik, Saarbrücken



Bidirectional path tracing (BDPT)



Our guided BDPT

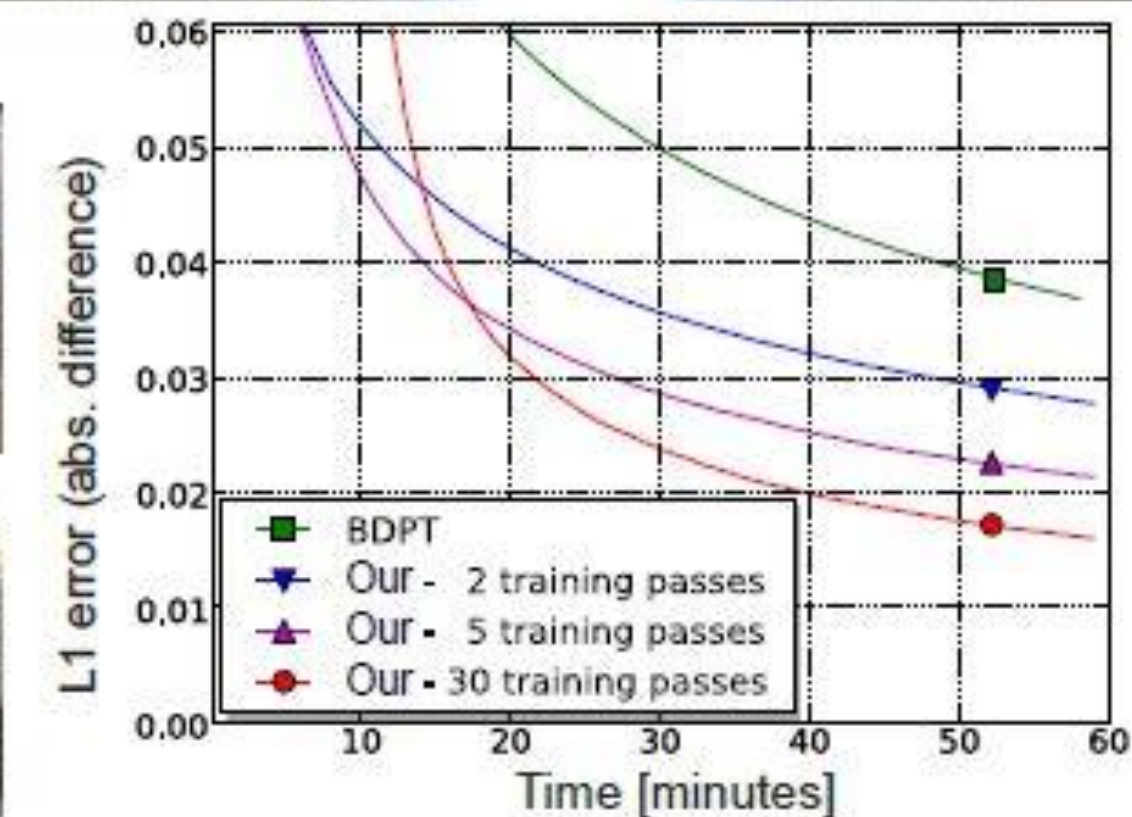


■ BDPT

▼ Our - 2 TP

▲ Our - 5 TP

● Our - 30 TP



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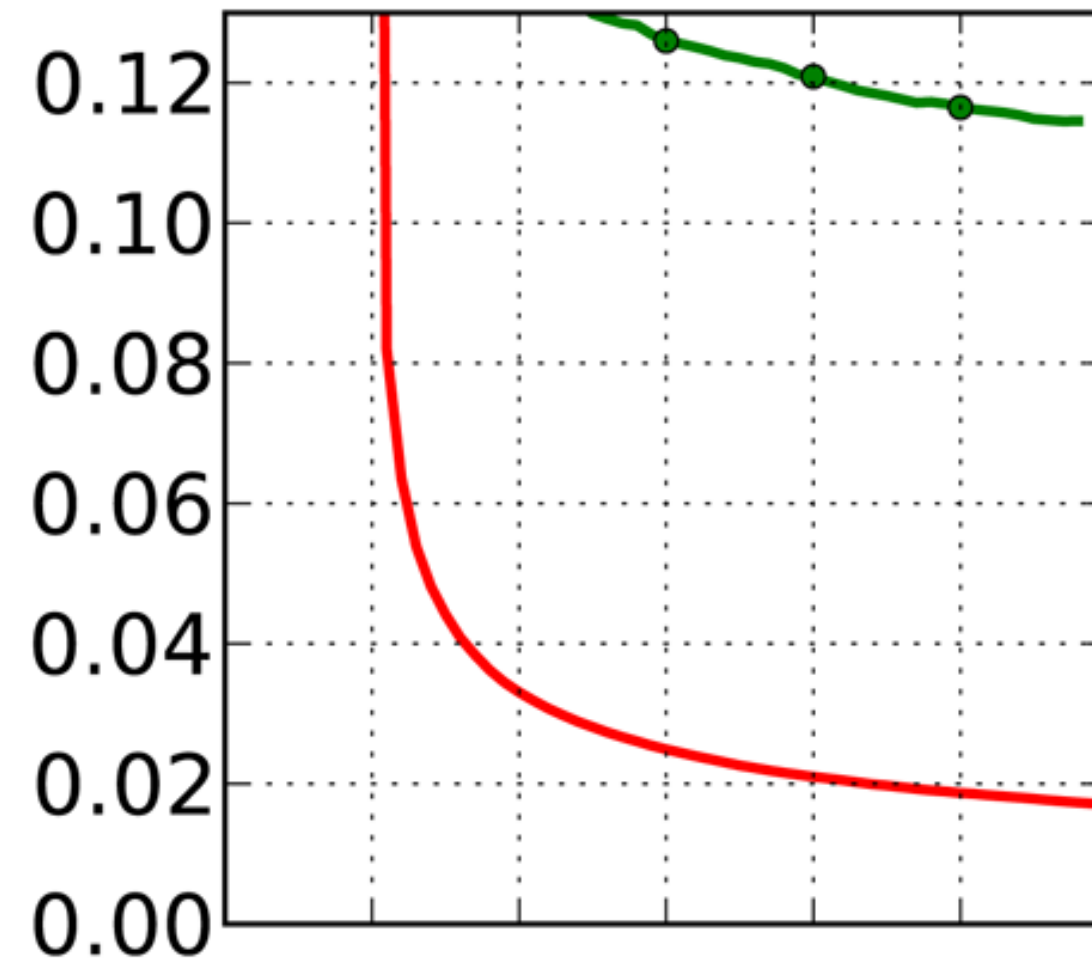
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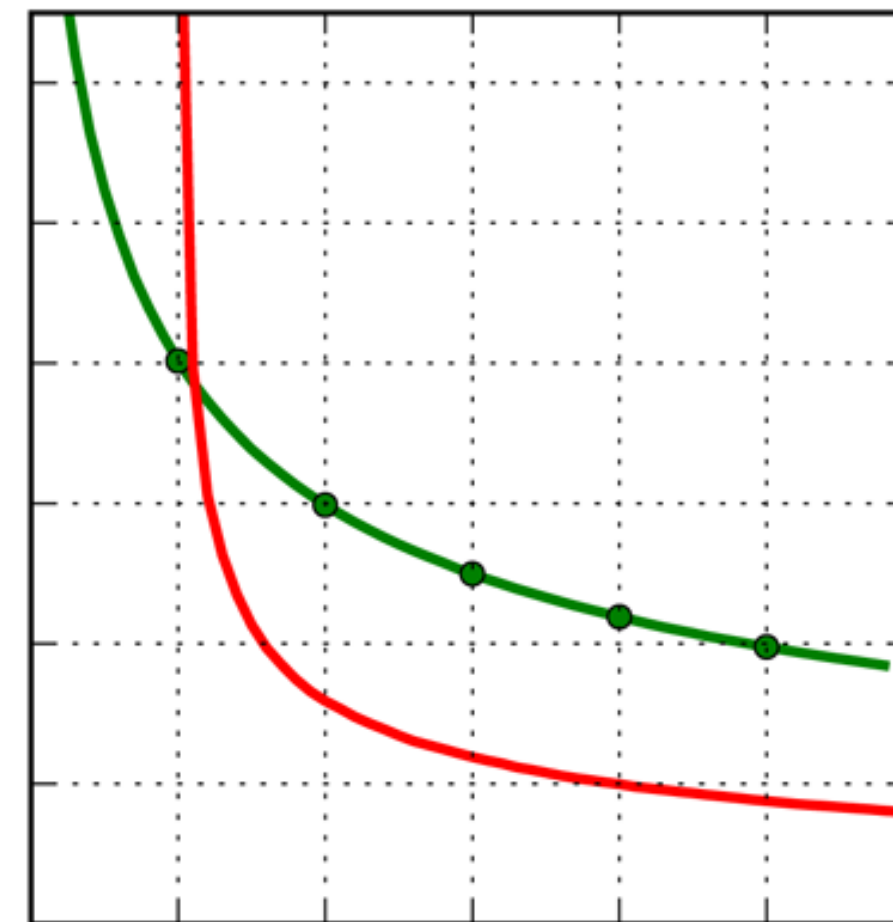
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L1 error (abs. difference)

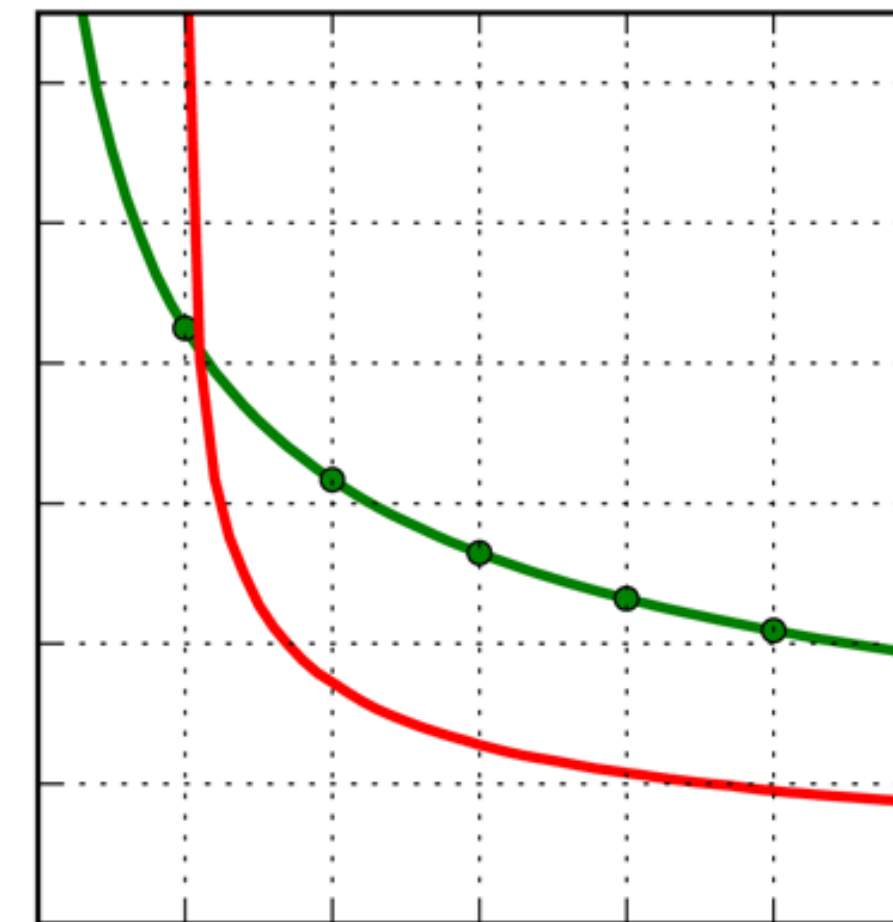
PT



BDPT



VCM



Living room



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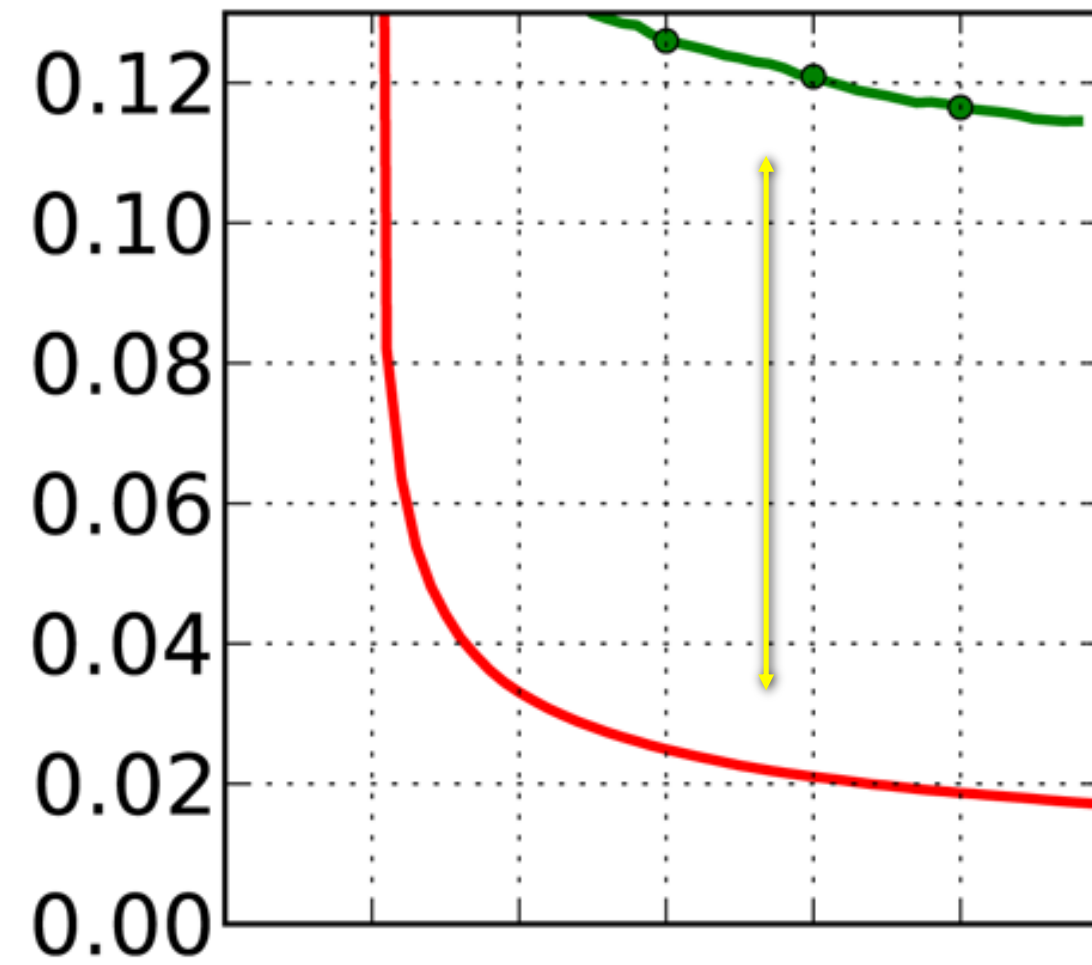
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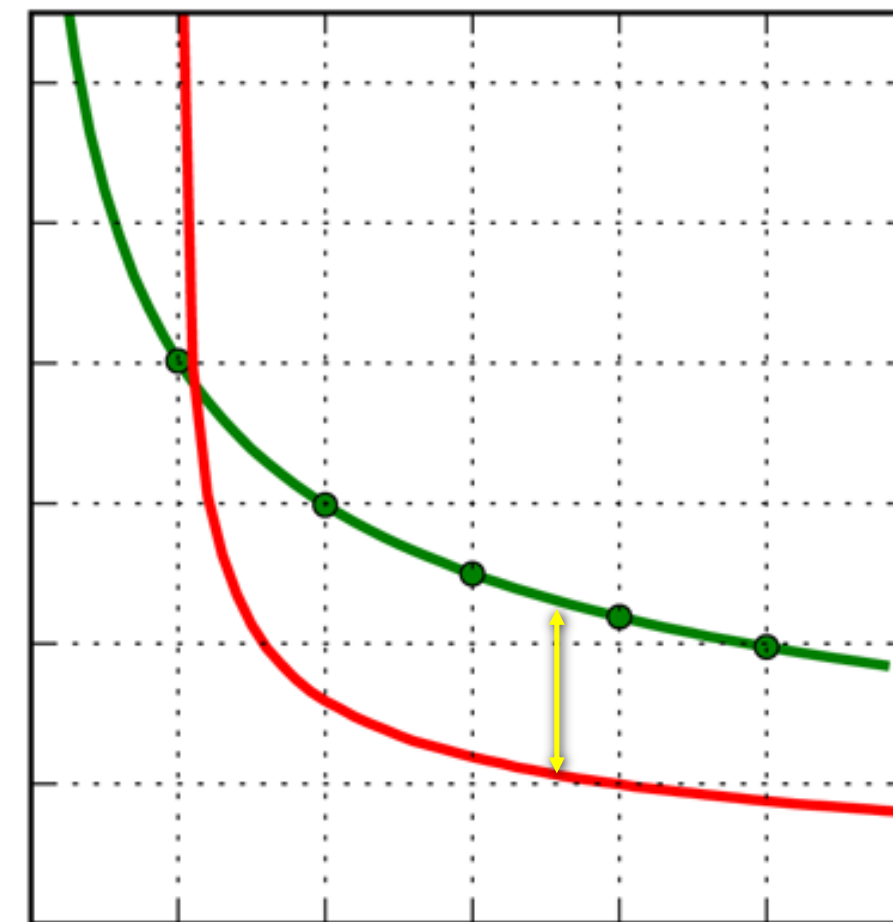
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L1 error (abs. difference)

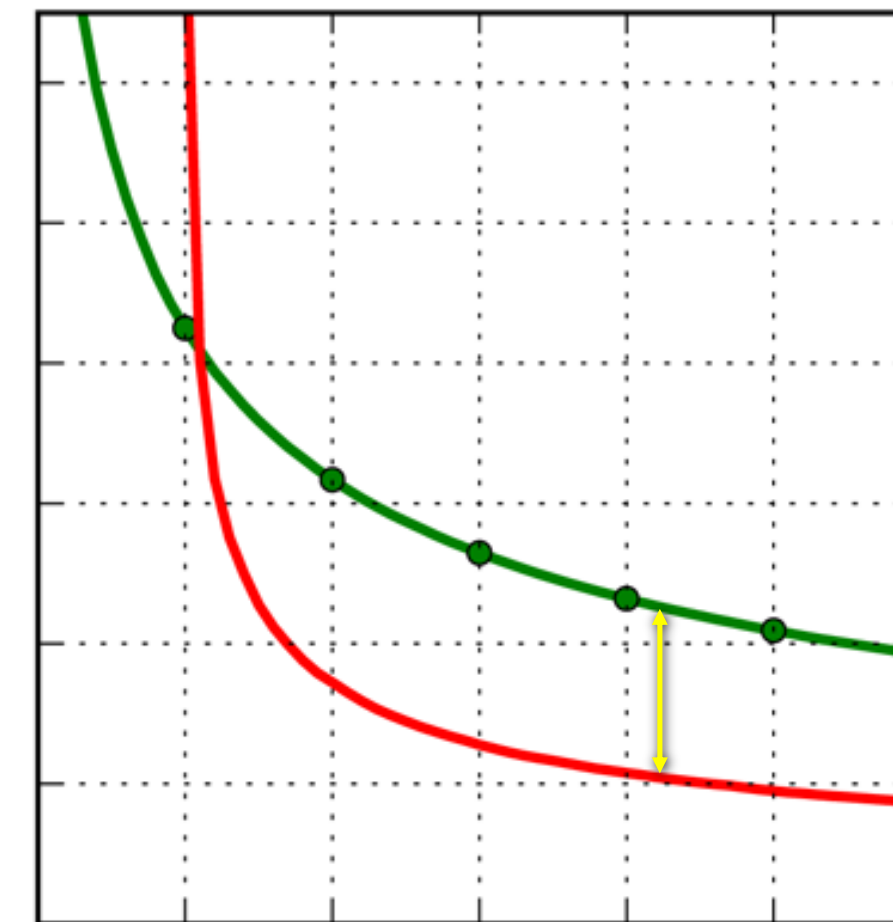
PT



BDPT



VCM



Living room



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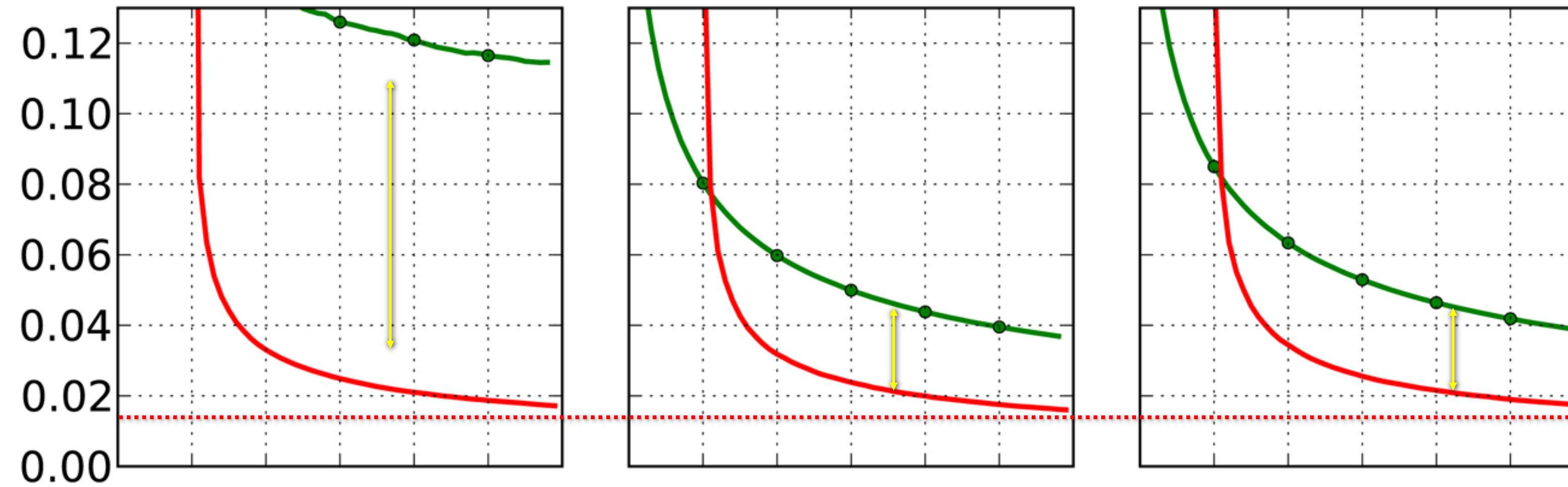
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PT

BDPT

VCM



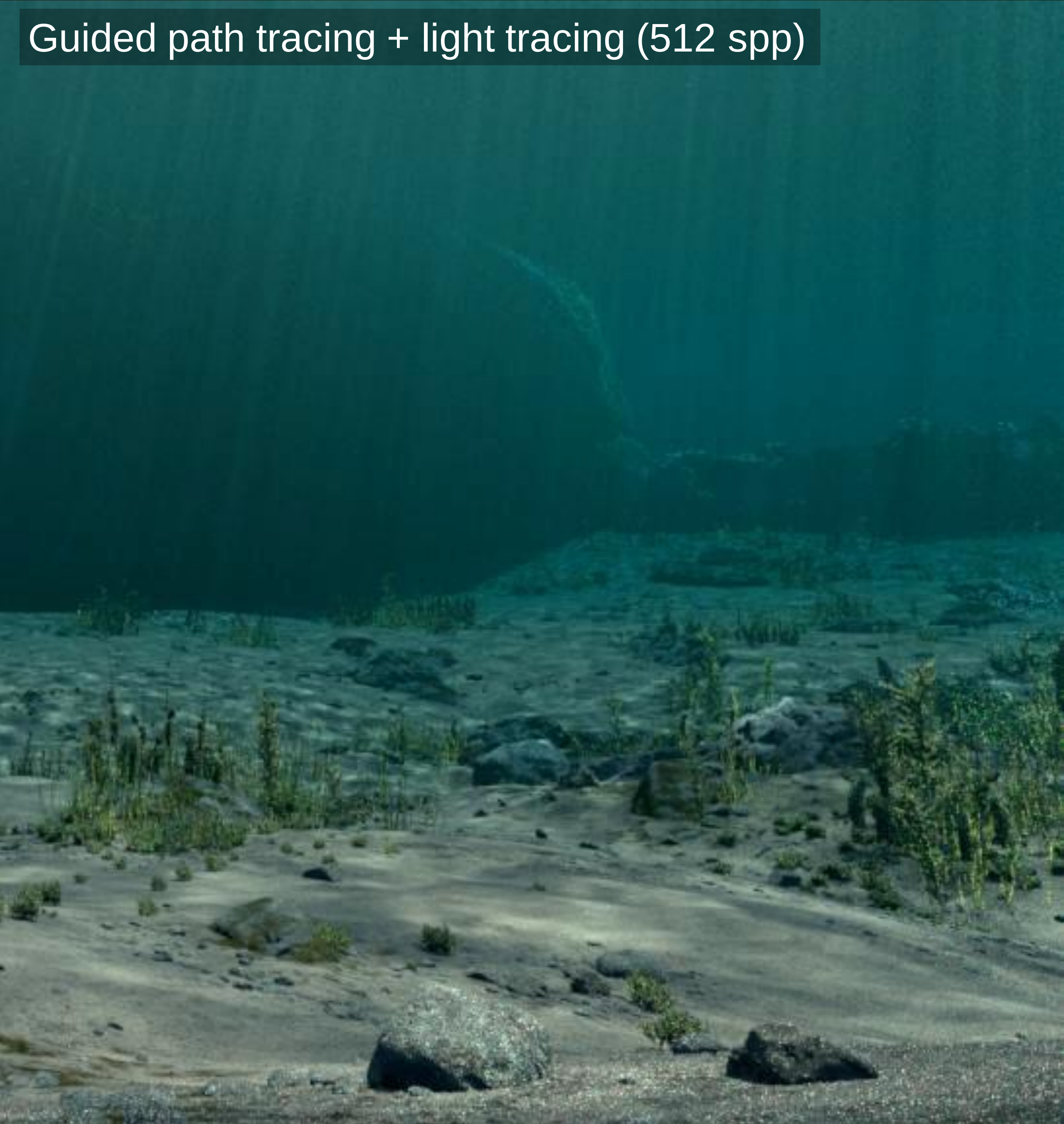
Living room



Guided path tracing (512 spp)



Guided path tracing + light tracing (512 spp)





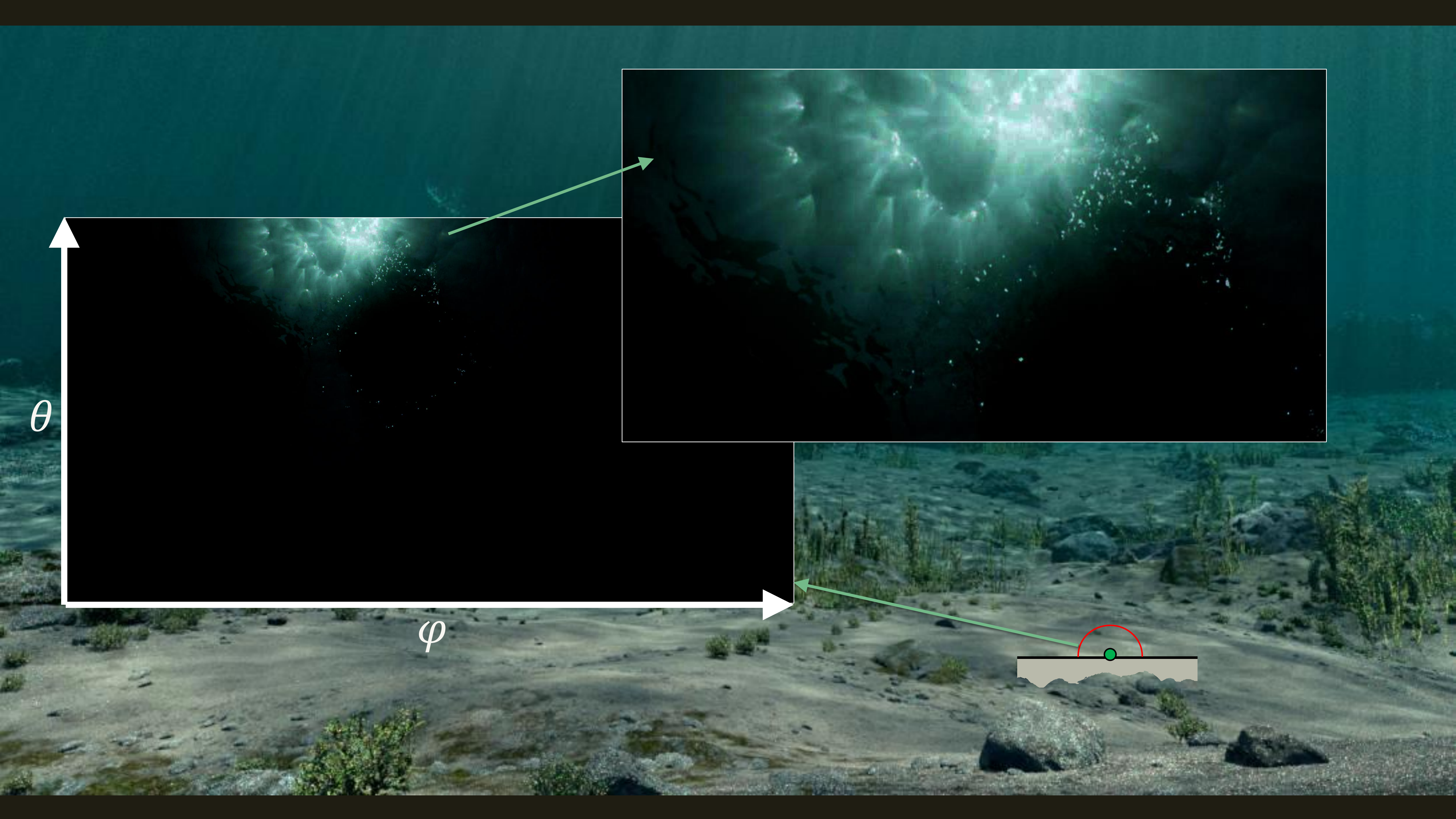




θ

φ

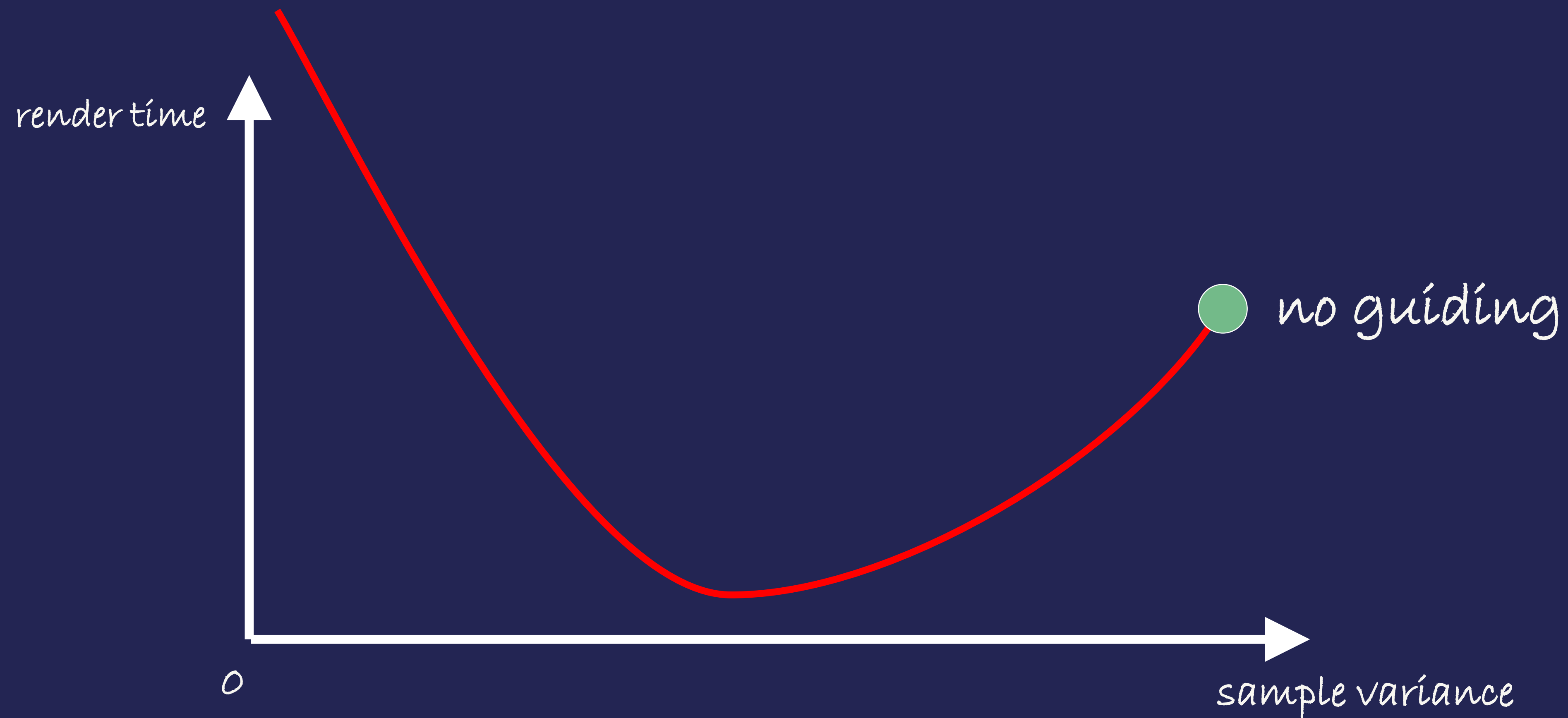




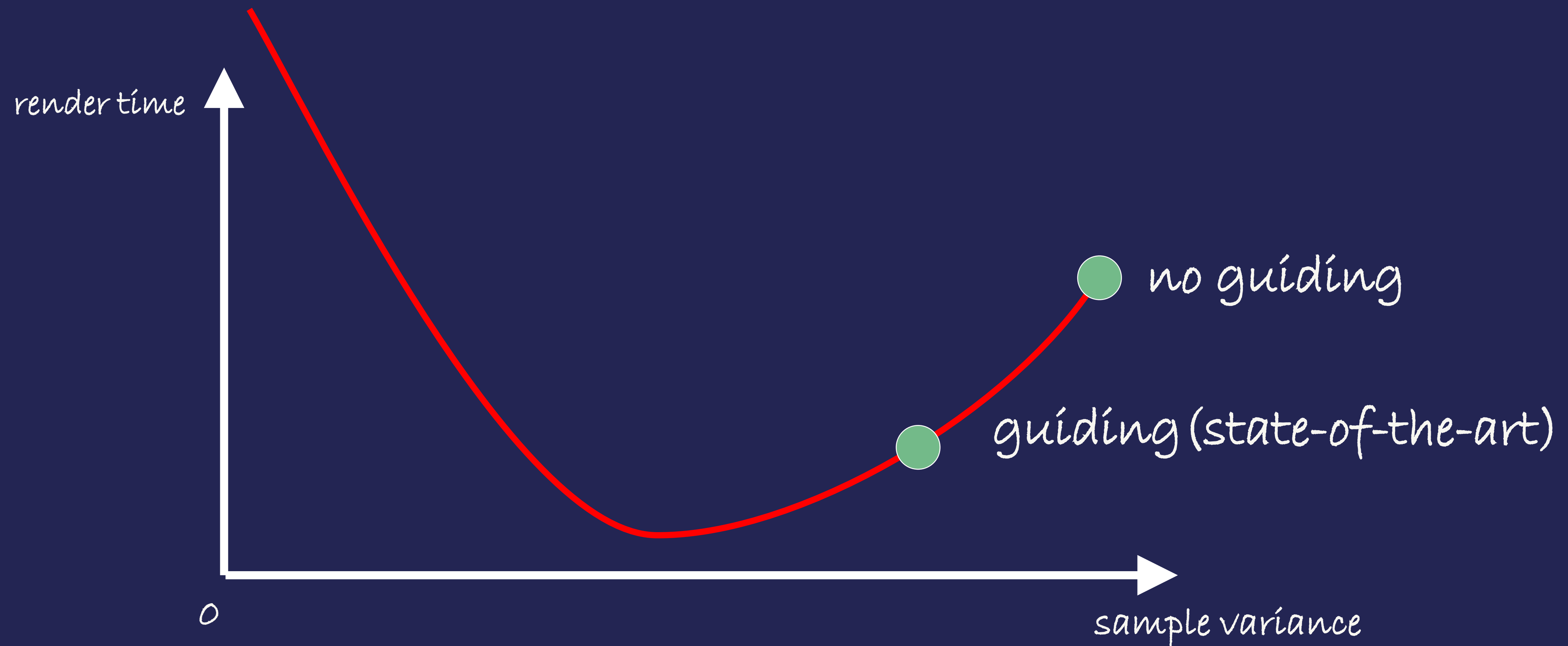
GUIDED PATH TRACING

LIMITS AND FUTURE WORK

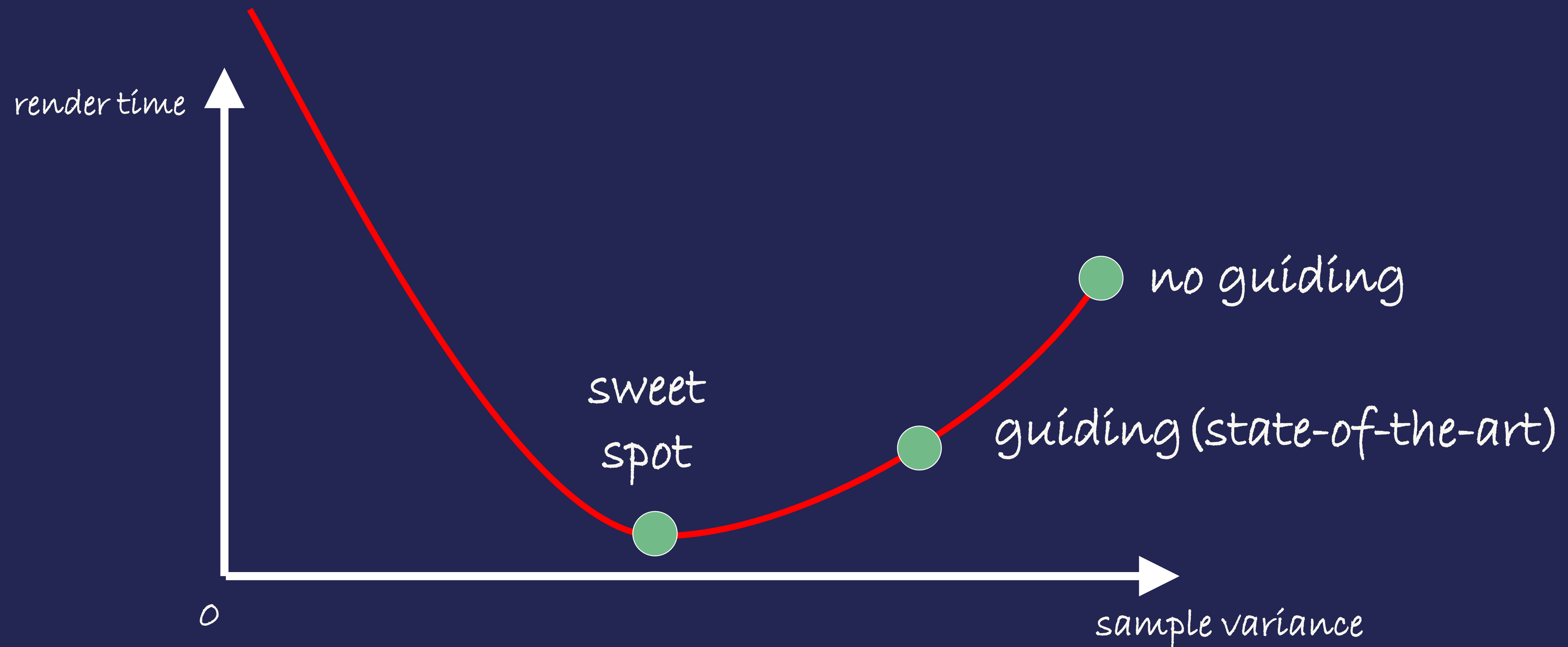
GUIDING LIMITS



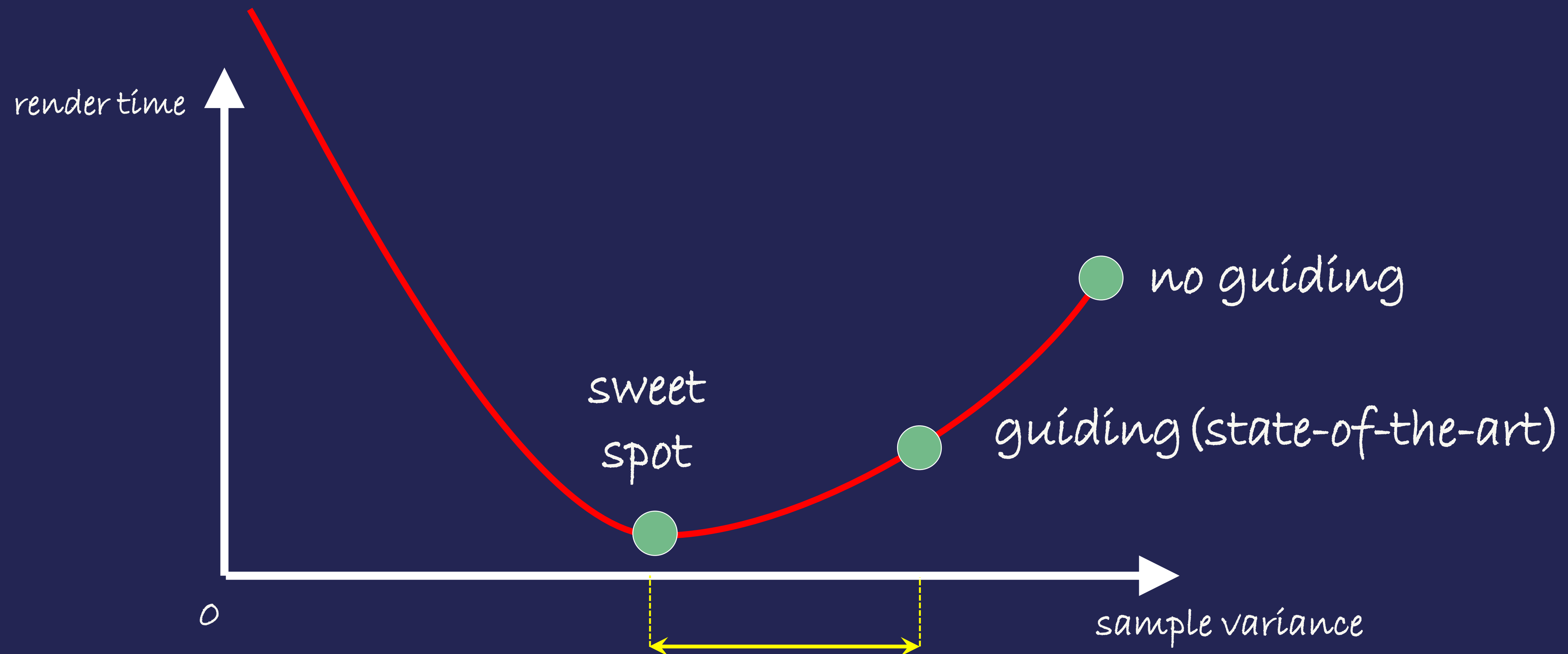
GUIDING LIMITS



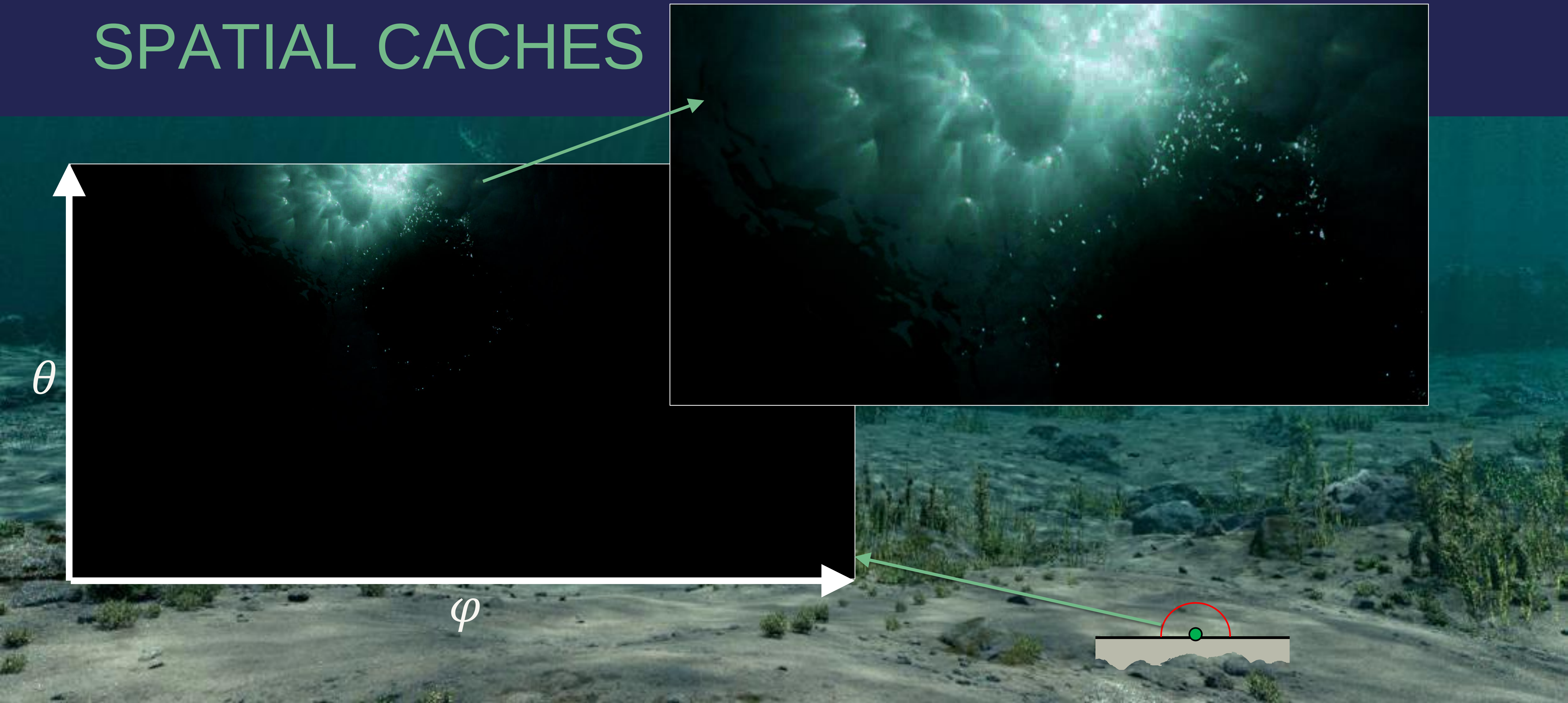
GUIDING LIMITS



GUIDING LIMITS



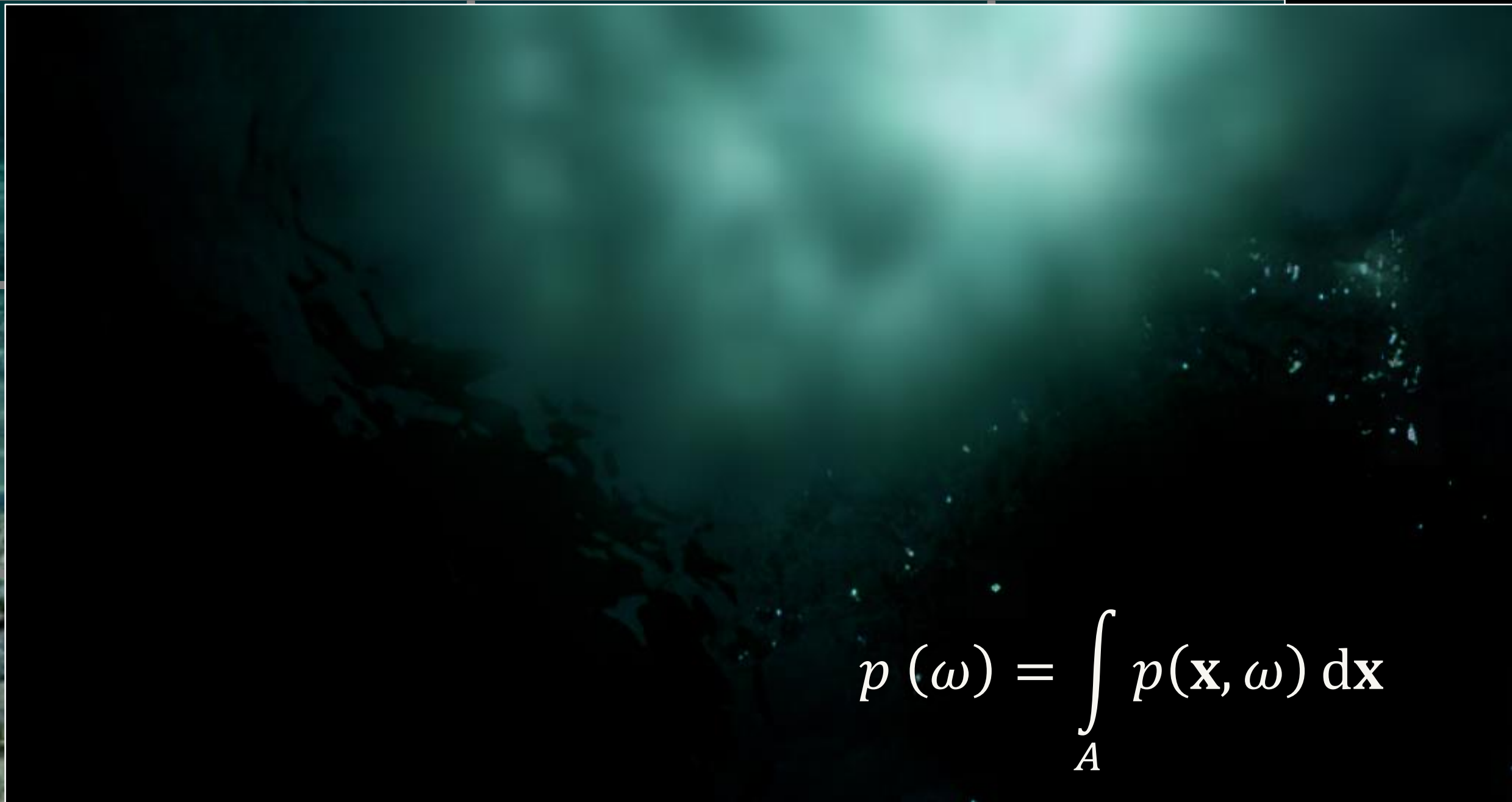
SPATIAL CACHES



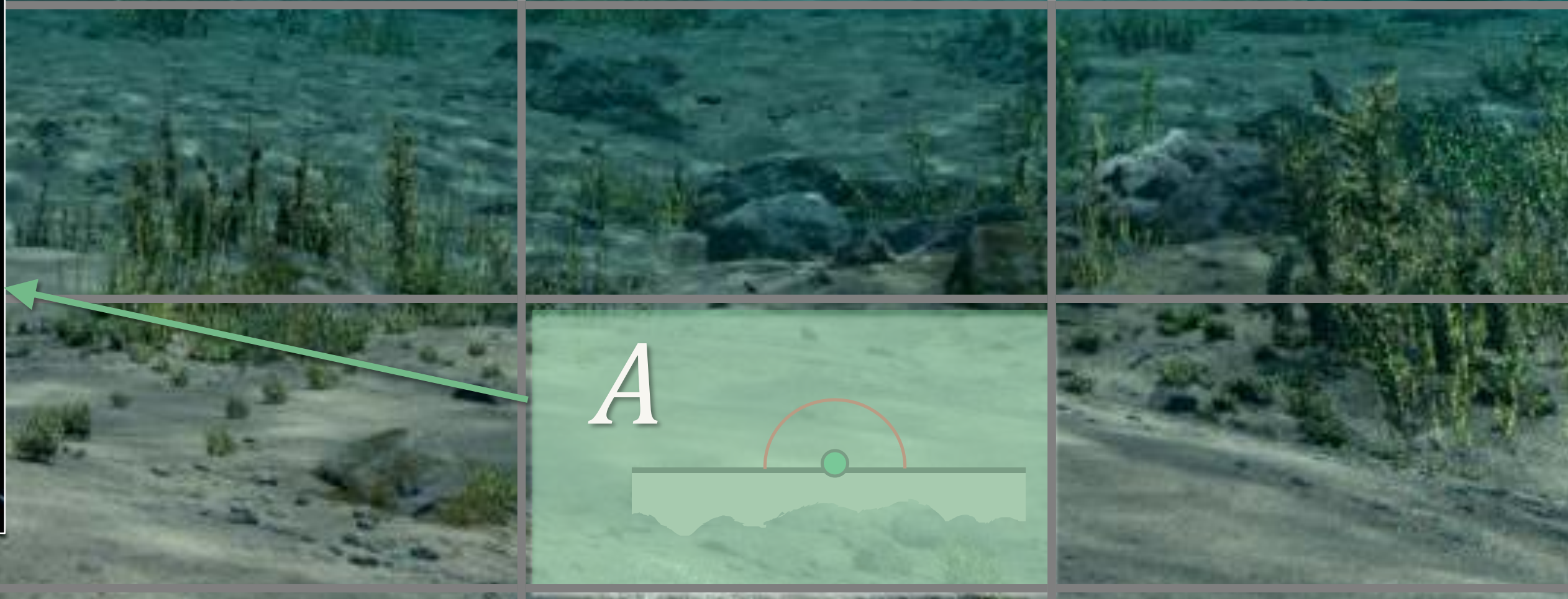
SPATIAL CACHES



SPATIAL CACHES



$$p(\omega) = \int_A p(\mathbf{x}, \omega) d\mathbf{x}$$



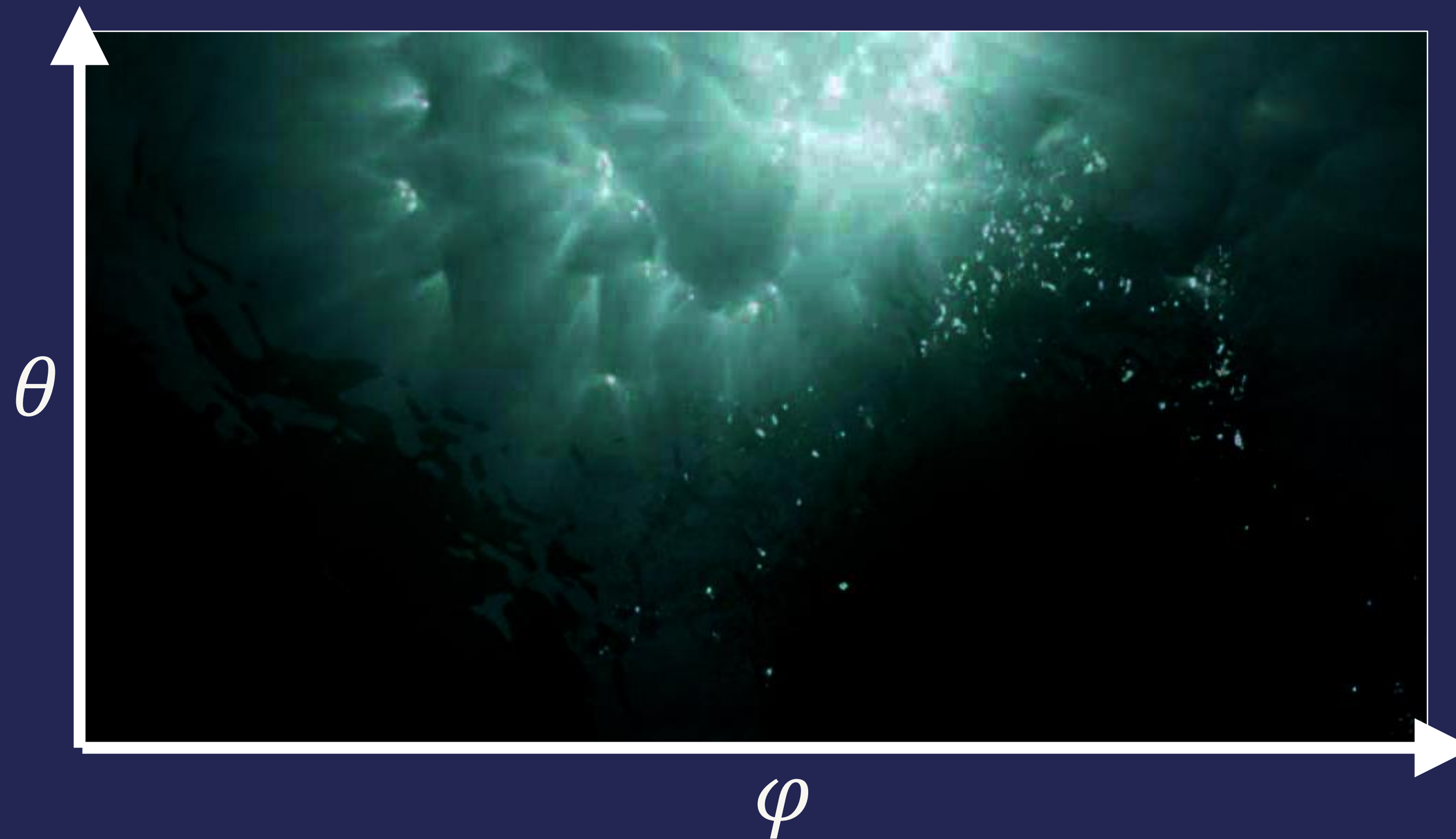
SPATIAL CACHES

- When subdivide?
 - Currently number of samples
 - Better criterion?
- When not to subdivide?

COMBINATION

- Cached 2D distributions & Guiding in path space
- Cached only for smoother multibounce
- Guiding in path space for lower dimensions

SECOND MOMENT GUIDING



SECOND MOMENT GUIDING



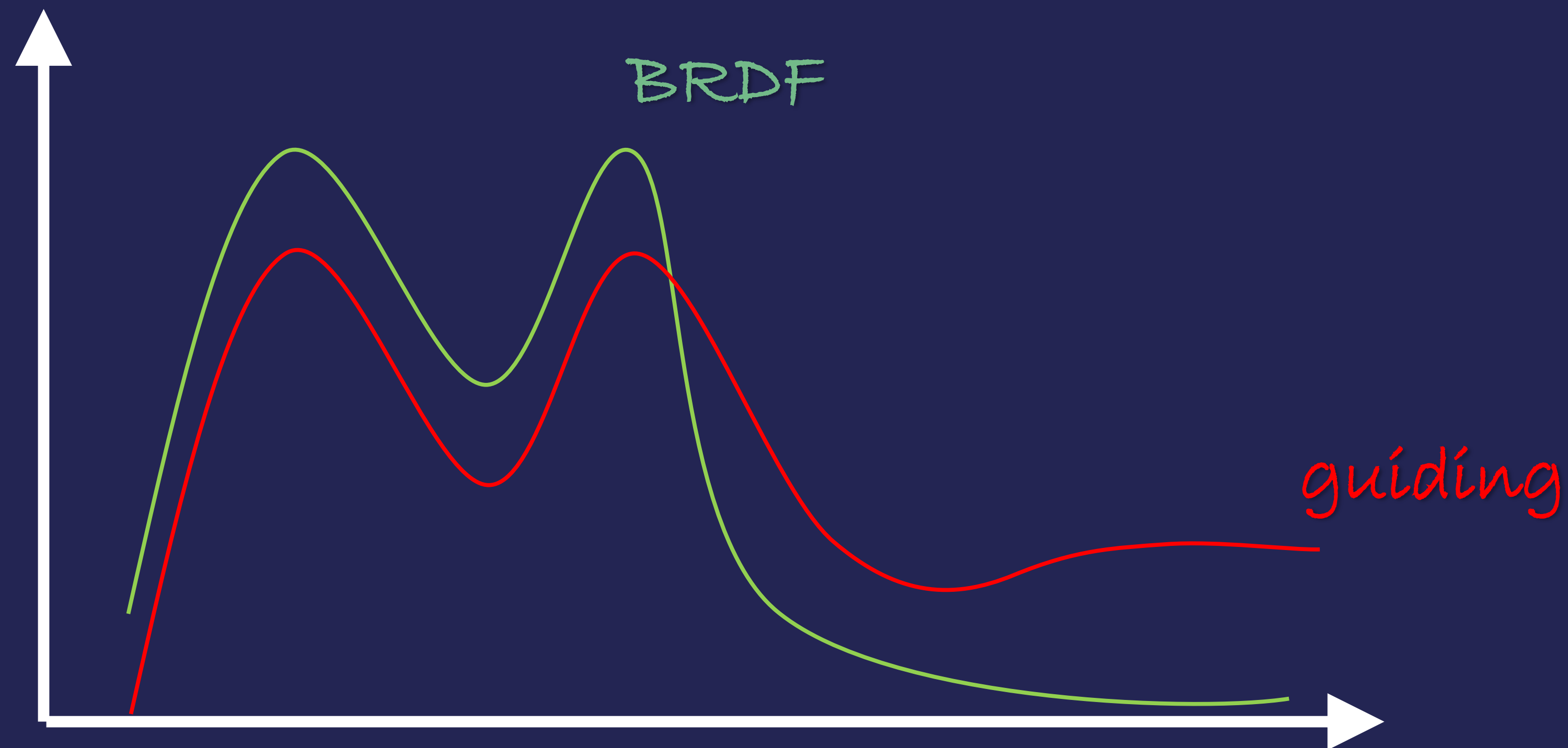
SECOND MOMENT GUIDING

- Redistribute samples
- Analogy: adaptive sampling of image



MIS

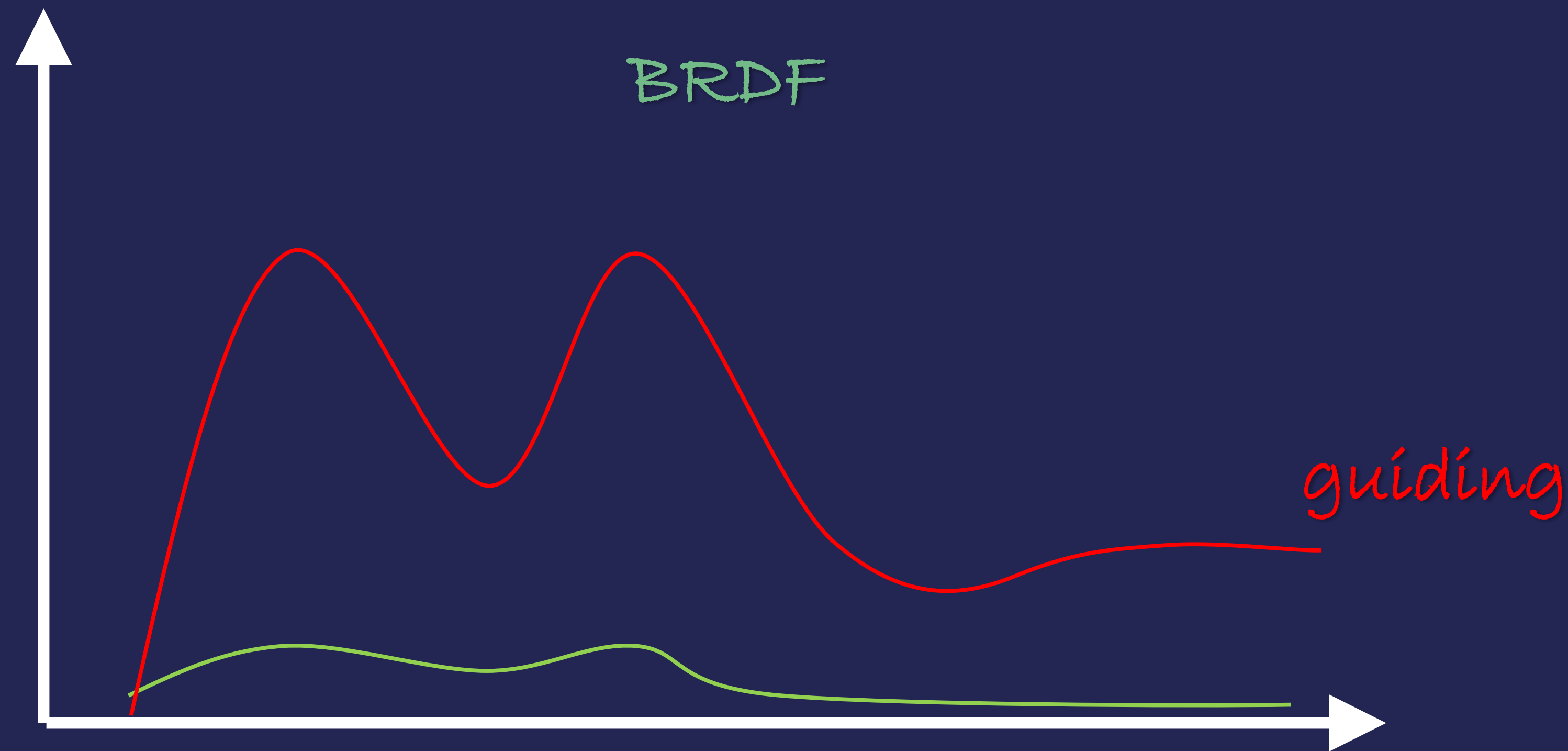
- Focus on the same part



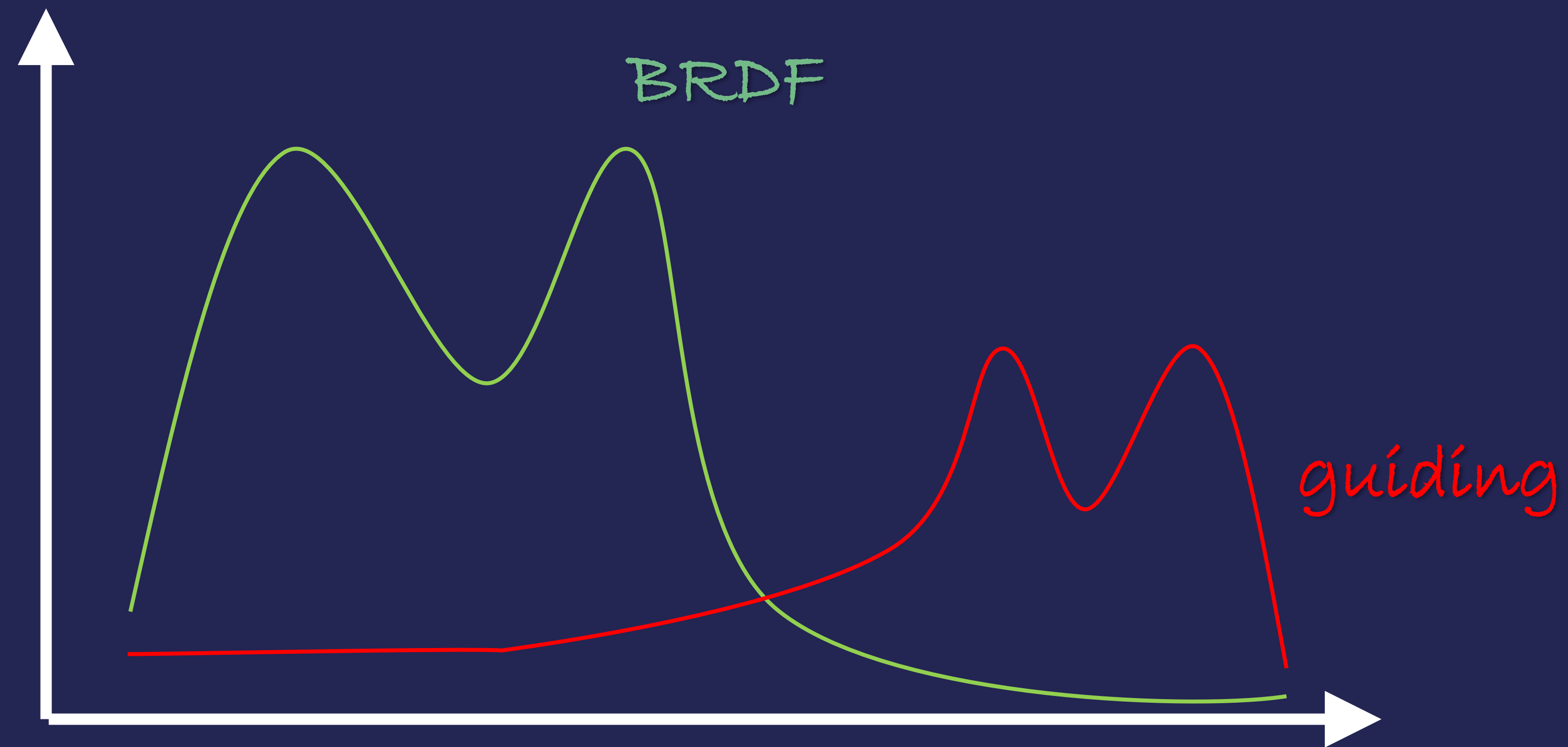
MIS SAMPLE ALLOCATION

- Thomas' PPG extension

$$\alpha \text{ BRDF} + (1 - \alpha) \text{ guiding}$$

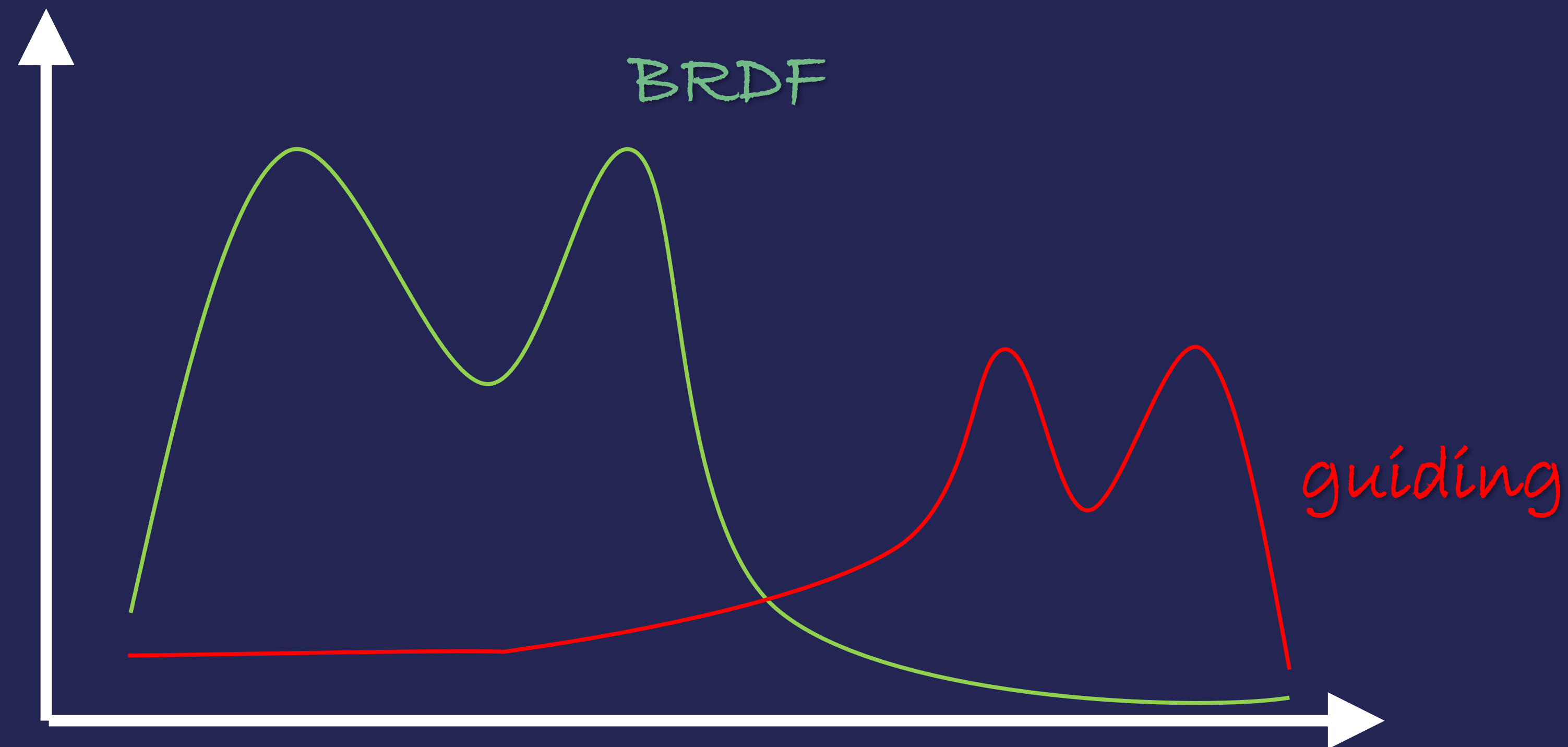


MIS COMPENSATION



MIS COMPENSATION

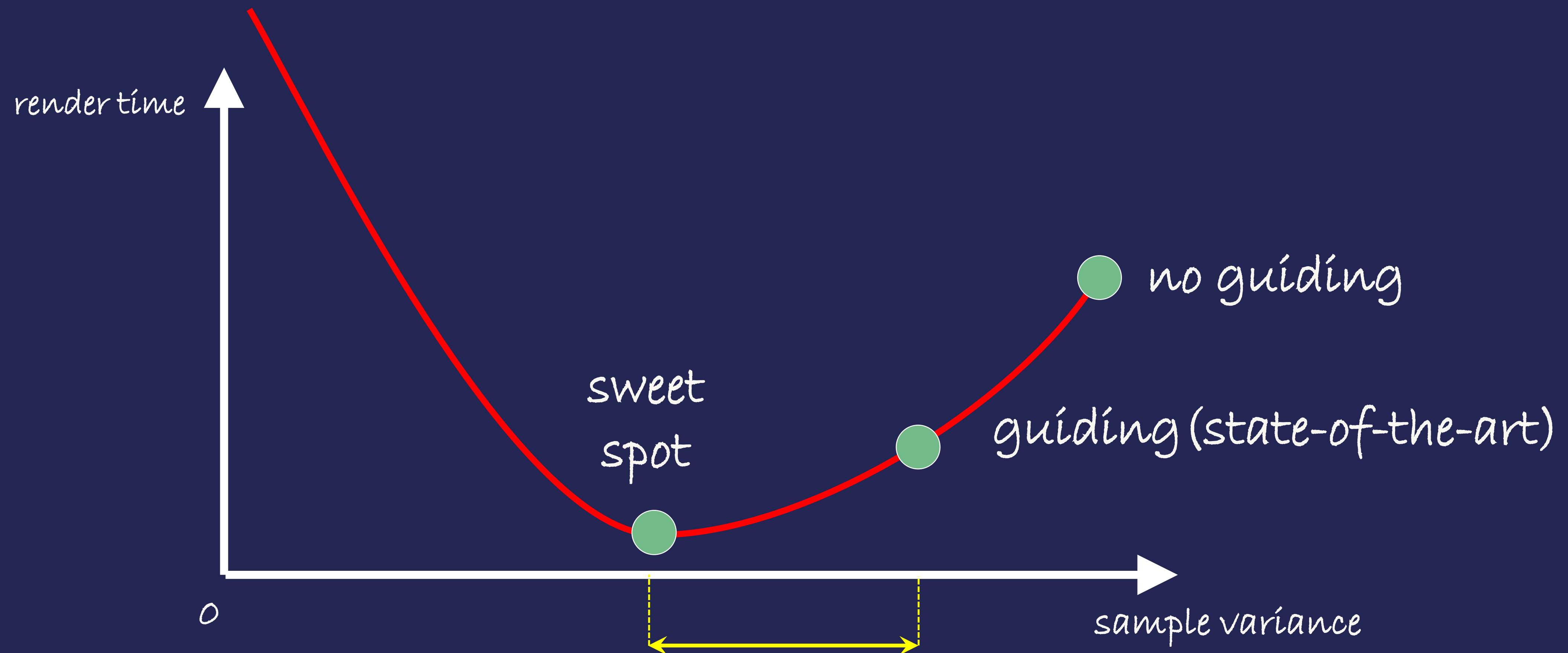
- Grittmann et al. [2018] – photon emission



NEURAL NETWORKS

- Dahm & Keller [2017]
- Zheng and Zwicker [2018]
- Müller et al. [2019]
- Hitting diminishing returns yet
- Utilize GPU

WRAPPING UP





THANK YOU

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